RENEWABLE ENERGY POTENTIALS IN SERBIA WITH PARTICULAR REGARD TO FOREST AND AGRICULTURAL BIOMASS

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Abstract In Serbian National Energy Strategy it is clearly stated that one of the main directives in upcoming years will be substitution of conventional fossil fuels with renewable sources. This opens up prospects for development of new business ideas for utilization of Serbian biomass resources which will undoubtedly contribute towards lessening domestic dependence on imported fossil fuels and consequently their environmental impact. Wood and agricultural biomass play key role in this as a two most important biomass resources in Serbia. The paper depicts the current situation and proposes options for future action.

Keywords: Energy efficiency, energy stability, biomass

1. Introduction

Biomass includes all kinds of materials that were directly or indirectly derived not too long ago from contemporary photosynthesis reactions, such as vegetal matter and its derivatives: wood fuel, wood-derived fuels, fuel crops, agricultural and agro-industrial by-products, and animal by-products (Van Loo and Koppejan 2008). It is a widespread source of renewable energy and the only source of renewable carbon. Additionally, it can be regarded as promising option for the large-scale economical production of

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renewable transportation fuels and chemicals. Worldwide production of terrestrial biomass has been estimated to be on the order of 200 × 10^{12} kg (220 billion tons) annually, which is approximately five times the energy content of the total worldwide crude oil consumption (via heat of combustion analysis) (Himmel 2008). Globally, interest in biomass projects has gradual but strong ascending trend with funding which totaled at least $4.8 billion in 2007 across 127 projects (Boyle et al. 2008).

Similarly, in Serbia interests for biomass are after years of stagnation in permanent rise. This urges for identification of locally available biomass resources as well as appropriate assessment of alternative economically acceptable biomass utilization technologies. To assist in identifying and prioritizing the indigenous biomass resources, the potential raw materials were grouped into two categories of special interest. These are:

- Wood biomass
- Agricultural biomass

2. Wood Biomass

Wood (forest) biomass is defined as the accumulated mass above and belowground of the wood, bark and leaves of living and dead woody shrub and tree species (Young 1980). One of the outstanding features of wood is that it is a readily renewable resource. Ash content in wood is very low. It is free of sulfur and other polluting and corrosive elements.

The challenge for energy production from wood is twofold. First to increase its share of energy supply in the developed countries; and secondly to retain and to grow its share of energy supply in the developing countries while introducing modern bioenergy production technologies (Walker 2006).

Wood raw materials are used selectively in forest industries. Even in the most favorable market conditions, industrial use of forest biomass is generally limited to stems that meet given dimensional and quality requirements (Richardson 2002). Remnants that are not used in future processes are referred to as residues. Most common classification divides forest biomass residues in *forest residues* and *wood processing industry residues*.

2.1. FOREST RESIDUES

In commercial harvesting operations, low-quality stems and other tree components, such as tree branches, tops of trunks, stumps and leaves are left at the site as forest residues.

2.2. WOOD PROCESSING INDUSTRY RESIDUES

Forest based industries fail to completely utilize the wood raw material at the mill, thus producing industrial process residues. In addition to primary process residues such as bark, sawdust, slabs and cores from the primary forest industries, downstream industries such as furniture manufacturing produce secondary process residues that are typically characterized by low moisture contents (Richardson 2002).

3. Serbian Wood Biomass Potentials

Forests in Serbia cover 2.36 million hectare, that is 27.3% of country area. Total forests area per inhabitant is 0.25 ha. Wood reserves are estimated at 235 million cubic metre of wood, using convenient methodological procedures. Pure beech forests represent 27.5%, oak forests 24.4%, other deciduous forests 8.5%, coniferous forests only 5.9% and rest are mixed deciduous–coniferous forests (Vukmirovic 2008).

According to the Republic of Serbia Spatial Plan afforestation will be significantly supported. It is planned to enlarge forests from 27.3% to 31.5% by 2010 and 41.4% by 2050 (Perisic 1996).

Enlargement is planed on the forest estates as well as on the estates which are incapable for agricultural production. Disposition of forests by the districts in the total area of Serbia is given in the Fig. 1.

3.1. FORESTRY OWNERSHIP STRUCTURE

The state owns 56.2% of the total forest area. The remaining 43.8% is under private ownership. The state owned forests in Serbia occupy area of about 1.021 million hectare. These forests are divided between seven public enterprises (PE): PE Srbijasume, PE Vojvodinasume and five PE National Parks.

PE “Vojvodinasume” is a new public enterprise, which was created by a law enacted in 2002, and became operational in early 2003. It is responsible solely for the management of state forests in Vojvodina. PE “Srbijasume” manages the rest of Serbian state forests.

The average size of private forests holdings is small (about 0.5 ha). Private forests tend to contain timber of poor quality, and are largely unproductive. Due to their small size and low productivity, owners can’t afford to pay for professional management of their forests. The timber produced in these forests is used mainly for domestic heating.

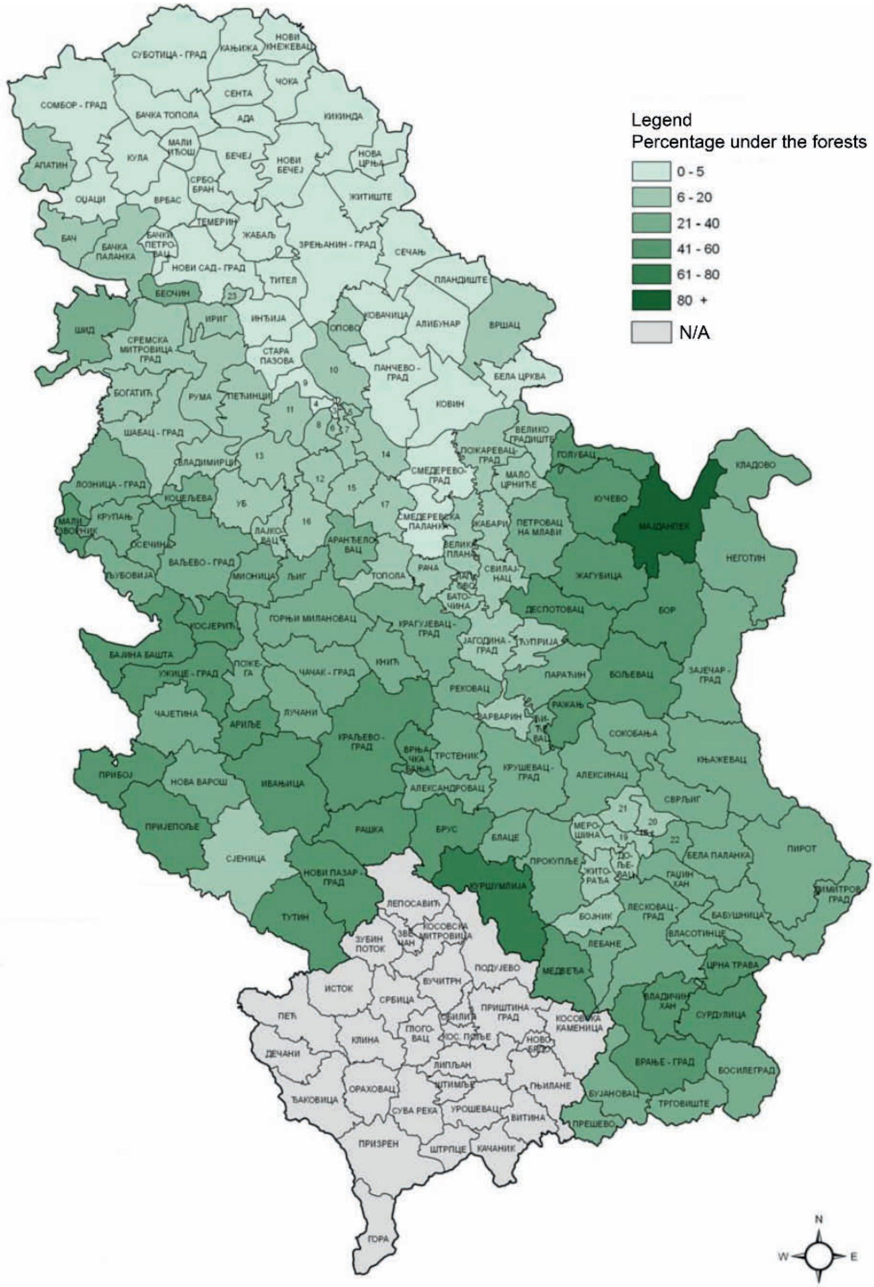


Figure 1. Forest area in the total area of municipalities in Serbia

Despite the fact that PE Vojvodinasume manages less than 20% of total forest area, it excels in sustainable forest management. This is primary based on their sound approach to artificial afforestation, especially with hybrid poplar species.

TABLE 1. Forests by area in 2005 (in 1,000 ha)

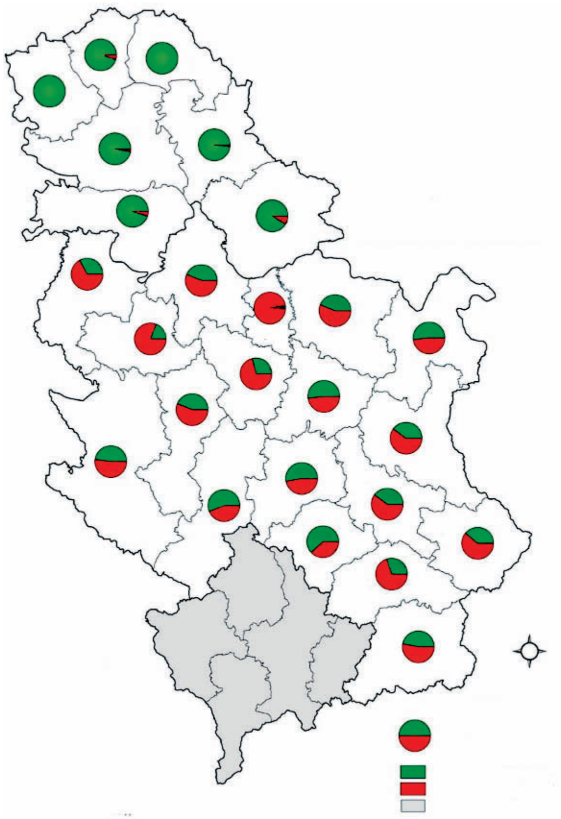
	Total	Pure stands	Broadleaved	Conifers	Mixed stand	Broadleaved	Conifers	Broadleaved conifers
	State forests							
Republic of Serbia	1021.4	746.7	626.7	120	274.6	194.3	36	44.2
Central Serbia	858.5	652.8	533.9	118.9	205.6	131.1	30	44.1
Vojvodina	162.9	93.9	92.7	1.1	0.069	63.2	5.6	0.1
	Private forests							
Republic of Serbia	963	671	608.8	62.1	292	269.5	13.3	9.1
Central Serbia	962.9	671	608.8	62.1	292	269.5	13.3	9.1
Vojvodina	0.1	0.1	0.1	0.001	–	–	–	–

Forest ownership structure as the clarification about district names are illustrated in the Fig. 2.

3.2. WOOD RESIDUES IN SERBIAN FORESTS AND WOOD PROCESSING INDUSTRY

Two forest assortments are produced from gross felled trees: round wood and stacked wood. In felling procedure part of the wood remains on the forest floor and is not used in further processes. That residue can be estimated at 12–18% of gross wood volume. Beside this residue from 100 m^3 of timber 15 m^3 remains on branches and approx. 25–30% on stumps and roots.

Average annual forest falling in Serbia can be estimated at 5.5 million cubic metre. According to the above calculations there are more than 3 million cubic metre of unused forest residues. Energetic value of unused forest residues is estimated at 43,000 TJ/year.



0. The city of Belgrade
1. North Backa administrative district
2. Central Banat administrative district
3. North Banat administrative district
4. South Banat administrative district
5. West Backa administrative district
6. South Backa administrative district
7. Srem administrative district
8. Macva administrative district
9. Kolubara administrative district
10. Podunavlje administrative district
11. Branicevo administrative district
12. Sumadija administrative district
13. Pomoravlje administrative district
14. Bor administrative district
15. Zajecar administrative district
16. Zlatibor administrative district
17. Morava administrative district
18. Raska administrative district
19. Rasina administrative district
20. Nisava administrative district
21. Toplica administrative district
22. Pirot administrative district
23. Jablanica administrative district
24. Pcinje administrative district
25. Kosovo administrative district
26. Pec administrative district
27. Prizren administrative district
28. Kosovska Mitrovica adm. district
29. Kosovo and Pomoravlje adm. district

Figure 2. State/private forest ratio by administrative districts in Serbia

TABLE 2. Structure of potential forest residues in Serbia

	Residues characteristics		Content		Note
	Moisture (%)	Dimensions	(%)	(m^3)	
Foliage	30–60	–	–	144,000	Neglected
Stumps and roots	40–60	Bulky	47.3	1,255,000	Remain in forest
Unmerchantable branches	40–60	Bulky	25.7	750,000	Partially used
Offcuts	40–60	Bulky and tiny	27.0	900,000	Partially used
Total			100.0	3,049,000	

Various techno-economical factors influence the purpose and scale of potential residues utilization. Most important are price of the residues, transportation costs and terrain type.

It is possible to utilize virtually 100% forest residues in plain, artificially grown forests estates. However, in natural mountainous counties utilized quantities are substantially reduced since transportation and lack of appropriate forest roads appear to be the dominant problems. These problems intrinsically influence feedstock price.

Forest residues obtained from sound forest management do not deplete the resource base. On the contrary, the utilization of such residues can enhance and increase future productivity of forests.

Wood processing industry also generates considerable amounts of wood residues that can be used as energy source. Wood residues can be in the form of solid matter (offcuts, shavings, chips) or in the form of dust from sawing. The Table 3 depicts estimates for the generation of residues for different types of processes. The estimates should be used with care since actual values will vary widely depending on local conditions, wood species and moisture content.

TABLE 3. Residues from various mechanical wood processing industry

Process	Residue type	Residue rate (%)
Saw-milling	Solid	38
Saw-milling	Sawdust	12
Plywood	Solid	45
Plywood	Dust	5
Particle board	Dust	10
Fiber board	Dust	10

Available technical capacitates for wood processing in Serbia are used almost completely after great recession in previous years. Average (on last tree year basis) annual trimmed wood usage is estimated to be as it is presented in Table 4.

TABLE 4. Average annual trimmed wood usage in Serbia in m^3

	Beech	Oak	Conifer	Poplar	Total
Serbia	464,712	69,730	117,882	660,194	1,312,518

According to the statistical reports forest industry in Serbia comprise 2,758 registered wood processing enterprises of which more than 90% are micro and medium sized firms in private ownership. Estimated number of employees in 2005 was 45,000 of which one third works in primer production and rest in final wood processing sector.

The forest industry in Serbia is in the process of transition. The first and foremost step in this process is privatization of forest harvesting and wood-processing sector. Government efforts and incentives are directed towards the creation of a positive investment climate for direct foreign investments in the wood processing sector, and the establishment of joint ventures between foreign and domestic companies.

4. Agricultural Biomass

Agricultural biomass refers to as lignocellulosic biomass that remains in the field after harvest of agricultural crops as well as crops planted exclusively for energy utilization. According to this, agricultural biomass can be divided into following classes:

- Agricultural residues
- Energy crops

4.1. AGRICULTURAL RESIDUES

Agricultural residues are by-products remaining after harvesting of agricultural crops. Residues can be divided into two main classes:

- Residues from herbaceous cultivation
- Residues from arboriculture

Residues from herbaceous cultivation include wheat, rye, barley, oats and rice straw; maize leaves, stalks, and cobs; soybean stubble; sunflower and rice husks, and bagasse.

Residues from arboriculture include pruning and residues from vine, olive and fructiferous trees.

Due to high collecting costs for most of the agricultural residues (collecting costs are substantially higher for agriculture than for herbaceous cultivation residues), they are not yet widely used for energy purposes. One of the main challenges for the emerging lignocellulosic biomass processing industry will be how to produce, harvest, store and deliver large quantities of feedstock to plants (refineries) in an economically feasible way.

4.2. ENERGY CROPS

The term energy crops can be used both for biomass crops that simply provide high output of biomass per hectare for low inputs, and for those that provide specific products that can be converted into other bio-fuels.

Inevitable, in the longer term, dedicated energy crops will have a much grater role to play. Energy crops can be produced as dedicated plants or in combination with non energy crops. This is new concept for farmers which have to be accepted if large scale energy crops are to become integral part of farming practices. However in USA some extraordinary results have already been obtained with herbaceous perennials such as switchgrass.

4.3. AGRICULTURAL BIOMASS POTENTIALS IN SERBIA

Land and climate conditions in Serbia are highly favorable to the development of agriculture. The plains of Vojvodina, Pomoravlje, Posavina, Tamnava, Krusevac and Leskovac offer favorable conditions for mechanized field crop planting and vegetable production.

Agricultural land covers 5,734,000 ha of which 4,867,000 ha are arable land (0.46 ha per capita). Farmland comprises 70% of the total surface area of Serbia (Vukmirovic 2008).

The Serbian agriculture and food processing industry plays an important role in the contribution to the Serbian GDP, employment and exports. Most of the agricultural production and processing is located on the territory of Vojvodina province and the northern part of central Serbia (FAUB 2005).

Despite great potentials, many difficulties hinder the process of development. Inherited ownership structure of husbandry, social structure of population, place, function and role of agriculture in rural and economy development as well as lack of clear and sound agricultural policy seems to be the dominant problems. From the total number of households in Serbia, 30.89% have agricultural farm. In rural areas from the total amount of households 60.96% are agricultural husbandries. Farms are small and parceled out. From the total number of agricultural husbandries in Serbia, 27.5% have land lesser than 2 ha and only 5.52% bigger than 10 ha. Process of parcels aggregation, modernization and introduction of sound agriculture practices started only recently. However, results are already visible (Table 5).

TABLE 5. Production of important cereals and industrial crops in Serbia (2003–2005)

	Area harvested (ha)	Production (t)	Yield per ha (t)
	Wheat		
2003	611,633	1,364,787	2.2
2004	636,289	2,758,017	4.3
2005	563,269	2,007,060	3.6
	Rye		
2003	6,057	8,225	1.4
2004	6,107	14,902	2.4
2005	7,168	15,778	2.2
	Maize		
2003	1,199,871	3,817,338	3.2
2004	1,199,921	6,569,414	5.5
2005	1,220,174	7,085,366	5.8
	Barley		
2003	109,626	194,371	1.8
2004	109,862	407,411	3.7
2005	104,917	310,850	3.0
	Sunflower		
2003	199,361	353,784	1.8
2004	188,696	437,602	2.3
2005	197,843	350,762	1.8
	Soybean		
2003	131,403	225,963	1.7
2004	117,270	317,836	2.7
2005	130,936	368,023	2.8
	Rape seed		
2003	3,212	3,809	1.2
2004	1,896	4,531	2.4
2005	1,730	3,333	1.9

Principal crops produced in Serbia are summarized in Table 5. It is very difficult to estimate amount of agricultural residues but as a starting point seed/plant residue ratio was used (Table 6).

TABLE 6. Seed/plant residues ratio

Field crop	Seed:plant ration
Wheat	1:1
Barley	1:0.8
Rye	1:1.1
Maize	1:1.1
Sunflower	1:2.5
Soybean	1:2
Rape seed	1:3

Based on prior considerations, potential energy content of unused agricultural residues can be estimated at 20,000 TJ/year. Unfortunately, just negligible part is used for energy utilization (most commonly direct combustion of wheat straw and maize cobs, stalks and leaves). Residues (especially straw) are mainly used as animal feedstock or incinerated in field.

Energy crops planting is confined to rape seed which is used for simultaneous production of biodisel and vegetable oil in first Serbian biorefinery with capacity of 30,000 t/year.

Utilization of agricultural residues in producing energy is economically feasible only if producing plant is located near harvesting field. Main obstacles for wider utilization of agricultural residues in Serbia lie in great expenses of collecting procedure, transport and storage. Since these problems are stumbling blocks even on a global scale, some time will be needed before agricultural residues become economically suitable for energy production.

5. Identification of Potential Biomass Utilization Technologies

In this section alternative biomass utilization technologies were reviewed. Only technologies that are capable for processing biomass resources attainable in Serbian were analyzed. Biomass utilization technologies can be divided into diverse categories based on the type of technology application being proposed and the type of biomass being utilized. For this particular study, biomass utilization technologies were categorized by product application as:

- Bioenergy technologies
- Bioenergy products technologies
- Biofuel technologies

In the following text overview is given for every corresponding technology. Overview was restricted to the most important features. Also, in order to form the basis for unbiased assessment of proposed technologies, information about investment cost for every technology was provided.

5.1. BIOENERGY TECHNOLOGIES

Bioenergy (biomass energy) technologies utilize biomass for the production of heat, steam and electricity. The potential of biomass energy is substantial but lack of proper policy is main obstacle of its proper utilization and development. This is particularly the case with agricultural and wood residues, which are unexploited resources.

5.1.1. *Direct Combustion*

Direct combustion is by far the most common and traditional way of producing heat from biomass. Combustion technologies convert biomass fuels into several forms of useful energy e.g. hot air, hot water, steam and electricity. The simplest combustion technology is furnace that burns biomass in combustion chamber. Biomass fired boilers are today convenient appliances that convert biomass to electricity, mechanical energy or heat.

Commercial and industrial combustion plants can burn many types of biomass ranging from woody biomass to municipal solid waste. Large scale combustion systems use mostly low quality fuels, while high quality fuels are more frequently used in small application systems. Today various industrial combustion systems exist which can be defined as fluidized bed combustion, fixed-bed combustion, and dust combustion.

Combustion technology still needs to be optimized. Fundamental breakthroughs are not expected, but rather small improvements considering cost reduction, increase of fuel flexibility, and reducing environmental impact.

Investment cost: 300 €/kW$_{th}$[1] for 40 MW$_{th}$.[2]production facilities (Ruchser 2000).

5.1.2. *Cogeneration*

Cogeneration is the process of producing two useful forms of energy, normally electricity and heat, using the same fuel source. In developing countries natural gas is mostly used as fuel source. Cogeneration plants can also be based on renewable resources like biomass. Energy experts foresee increasing role of cogeneration in power supply since dissemination is substantially stimulated by the changes taking place in the electricity sector. This technology for certain offers the potential for a much cleaner environment.

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[1] W$_{th}$ stands for Watt thermal.

[2] For direct combustion, pelleting and briquetting facilities investment costs are lead down to 40 MW$_{th}$ facility while for rest of the technologies investment cost were deduced to 400 MW$_{t}$ facility.

Cogeneration plants on large scale are an established technology that is cost competitive with conventional power. Challenges are directed towards micro cogeneration plant as a direct replacement of conventional gas fired boiler. Most promising features of micro cogeneration plants are fuel flexibility control. This technology is still in emerging phase and first units are on commercial trial.

Investment cost: 400–500 €/kW$_{th}$ for 40 MW$_{th}$ production facilities (Ruchser 2000).

5.1.3. *Gasification*

Gasification is one of the most important ongoing energy research areas in biomass for power generation as it is the main alternative to direct combustion. Gasification is the process of decomposition of solid and liquid organic materials into a combustible gas by controlling the amount of oxygen available. The product gas consists of carbon monoxide, carbon dioxide, hydrogen, methane, trace amounts of hydrocarbons, water nitrogen and various contaminants such as char particles, ash and tars. The importance of this technology relies on the fact that it can take advantage of advanced turbine designs and heat recovery steam generators to achieve high energy efficiency. Gasification processes are relatively insensitive to input material but feedstock with higher moisture content will generally give a gas with lower heating value. Although gasification has not reached a commercial status yet, it is widely accepted that, if fully commercialized, it will bring many environmental and economic benefits. This technology is close to commercialization with over 90 installations and over 60 manufactures around the world (data from 2002).

Investment cost: 550 €/kW$_{th}$ for 400 MW$_{th}$ production facilities (Sims 2002).

5.1.4. *Pyrolisis*

Pyrolysis is process of decomposition of complex organic molecules in the absence of oxygen to produce tree main energy products in different quantities: gas, oil and coke. The main advantage of pyrolysis over gasification is exactly in wider range of products that can potentially be obtained. From that, pyrolisis is more profitable technology. Pyrolisis technology has been studied in the past decade in many countries and findings are promising. Any form of biomass can be used, but cellulose gives the highest yields. Liquid oils obtained from pyrolysis have been tested for short periods on gas turbines and engines with some initial success, but long term data is still lacking.

Investment cost: 350–1,000 €/kW$_{th}$ for 400 MW$_{th}$ production facility (cost depends on production process) (Sims 2002).

5.2. BIOENERGY PRODUCTS TECHNOLOGIES

Bioenergy products technologies are classified in separate category to distinguish them from bioenergy and biofuels production. Bioenergy product can be regarded as value added bio based manufactured products.

5.2.1. *Carbonization*

Carbonization is technology for biomass conversion to charcoal for use as a boiler fuel. Another approach is referred to as torrefaction, low temperature carbonization process that produces a substitute product for conventional charcoal in some applications. These technologies can create a various bio carbons (e.g. charcoal and carbonized charcoal) for retail use. Contrary to the general view, charcoal consumption has increased in recent years and is becoming an important source of energy as people from rural and urban areas of developing countries shift from wood to charcoal use.

Investment cost: 600 €/kW$_{th}$ for 400 MW$_{th}$ production facility (Sims 2002).

5.2.2. *Pelleting*

Pelleting is process of densification of raw material into a steady and mechanically stable form. Pellets standardized size, allows the manufacturers of boilers, even at the low output range, to implement fully automated combustion and heating system. The compaction of pellets under the great pressure enables the wood pellets to remain stable even under mechanical loads during transport and filling, until they come to be burned. Even if the production of wood pellets with its pressing and drying processes is energy intensive, the energy requirements are well below 2% of the energy content of the end product. At this rate, wood pellets are significantly better than fossil energy sources, for which 10–12% of their own energy content is required for their refinement. Almost all types of agricultural and woody biomass are in principle suitable raw materials for pellet production. In order to keep costs for drying and grinding low, dry sawdust and wood shavings are used predominantly. The production of pellets from bark, straw and crops is usually more appropriate for large scale systems. Research indicates that wood pellet production is in principle economically possible both in small scale (up to 100 t/year) as well as in large-scale plants (10,000 t/year) – with the risk of production being uneconomical higher in smaller plants (less than 1 t/h).

Investment cost: 95 €/kW$_{th}$ for 40 MW$_{th}$ production plant (Mitic 2008).

5.2.3. *Briquetting*

Briquetting is process alike to pelleting with final product similar to split logs. In most cases briquettes have circular cross section with diameter of between 5 and 10 cm and of any length depending on the briquette technology used. Until recently the briquettes were considered the pellets poor relation because, since it doesn't have the same characteristics of availability such as ease of distribution (deliverable by tanker) and a wide range of combustion systems on offer even for individual homes. In most cases raw material is simply compressed without the addition of glues or additives but there is possibility to use different binding materials and additives to form briquettes with predefined features.

Investment cost: 130 €/kW$_{th}$ for 40 MW$_{th}$ production plant (Mitic 2008).

5.3. BIOFUEL TECHNOLOGIES

Biofuels are another category of potential products that can be produced from biomass. Biofuels are typically considered to be liquid transportation fuels generated from biomass. Since this study is confined to Serbian biomass resources, ethanol and biodiesel seems to have most economical potential.

5.3.1. *Ethanol*

Fuel ethanol can be produced from starch or cellulose. Starch hydrolysis for ethanol production is a mature and proven technology. Bioethanol can be produced from various kinds of biomass but only few crops contain simple sugars, which can be easily separated and made available to the yeast in the fermentation process.

The conversion process of lignocellulosic biomass to ethanol only differs from the process described above with respect to the break down of the raw material to fermentable sugar. This hydrolysis process is more difficult than the hydrolysis of starch. Current research and development activities are mainly focused on this issue. Technology is not available on a commercial scale yet and scaling up still proves difficult and commercially unattractive.

Investment cost: 290–400 €/kW$_{th}$ for 400 MW$_{th}$ production facility (first given price is for ethanol produced from sugar-containing crops and the second for ethanol production from lignocellulosic raw materials) (Hamelinck 2001).

5.3.2. *Biodiesel*

Biodiesel is another type of biofuel that can be produced from biomass. It is produced from vegetable oils, which can be derived from oil crops. Vegetable oils have been used as a fuel for a long time already. The conversion of biomass into vegetable oils for automotive fuel applications is similar to the production of vegetable oils for the food industry, which is a well-established process. In most cases the use of biodiesel does not require any adjustments to the engine. Moreover, for the most part, it is possible to use a fuel blend and the existing injection system.

Investment cost: 350 €/kW$_{th}$ for 400 MW$_{th}$ production facilities (Mitic 2008).

6. Closing Remarks

Selection of most suitable biomass utilization technology largely depends not only on technological but on series of socio-economic, environmental and political conditions. In addition, biomass and bioenergy is intrinsically interlaced with land use and labor. This implies that bioenergy programs have to be thoughtfully designed in order to ensure that varying needs are met, for example:

- Satisfying/improving basic needs
- Providing income opportunities
- Making good and effective use of land resources
- Promoting health needs and environmental protection (Heinloth 2006)

Government regulatory role (particularly through subsidizing) in these issues is decisive. Although, in some cases opposite is true. The notable exception is Brazil, where extensive investment in the sugar cane industry helped its well-established bioethanol industry to flourish. It is one of the few countries capable of generating biofuels economically and efficiently, independent of government incentives (Boyle 2008).

Present situation in Serbia renewable energy sector reveals that some pioneering efforts have already been made. This originally pertains to projects grounded on mature and proven technologies (co-combustion, pelleting, briquetting and biodiesel production technologies). First results indicate that even without concrete government support these production facilities could work profitably. However for wider acceptance of renewable energy technology and appropriate market development concrete government incentives are needed.

In order to achieve better, meaning acceptable and sustainable energy policy, Serbian government is obligated to promote clear political will, arrange the energy sector (in terms of national laws harmonization) and encourage further researches and commercial utilizations. Incentives related to renewable sources usage are more than welcomed. It is expected from government to provide concrete financial impetus for renewable energy project and according to recent official announcements this is hopefully going to happen in near future.

Finally, we must be aware that further activities regarding the decrease of fossil fuels consumption will not be possible without renewable resources promotion.

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